Atmospheric Effects on the Wind Retrieval Performance of Satellite Radiometers

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Ocean winds are important to weather prediction and global climate studies. They drive ocean currents which can transport thermal energy over large distances, and they provide clues about the nature of the atmospheric circulation patterns which affect weather all over the planet. A satellite borne radiometer can be used to measure the surface winds over the oceans because the winds affect the emissivity of the surface. The emissivity of the ocean surface is determined by physical factors such as the dielectric contrast, and the surface roughness. Small scale roughness generated by surface winds modifies the emissivity by scattering the emitted radiation over a range of directions. The emitted radiation is a function of the relative azimuth angle with respect to the wind direction. The wind speed and direction can be determined by measuring the emission from several different azimuth directions.

The radiation emitted by the ocean surface is also affected by absorption and radiation in the atmosphere before it reaches the satellite radiometer. In the microwave frequency range, the most important factors are water vapor and liquid water in clouds. Thus, the atmosphere represents a source of bias and noise in the surface emission signal. In this presentation, we will examine the impact of the atmosphere on multi-frequency satellite radiometer data using a radiative transfer model. The atmosphere is modelled as layers with different temperatures, humidities, pressures etc., using information from the National Meterological Center. The absorption and radiation characteristics of the atmosphere are derived from a millimeter wave propagation model (MPM) described by H. Liebe. In particular, we will look at how atmospheric absorption affects the azimuthally varying signal from the ocean surface, and how it affects the overall radiometric brightness level.